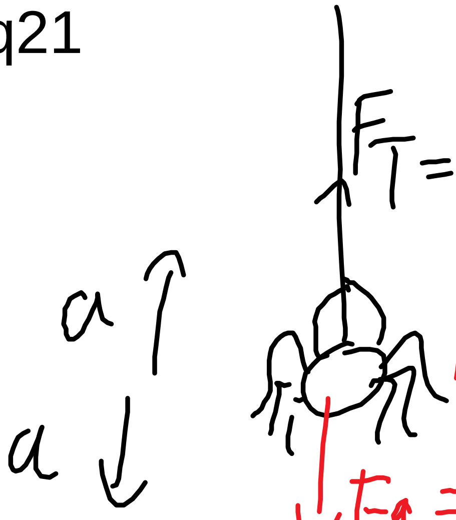
Review Problems from Chapter 5

p107 q21



$F_T = 2.0 \times 10^{-3}\ N$

$m = 2.1 \times 10^{-4}\ kg$

$F_g = mg = (2.1 \times 10^{-4}\ kg)(9.8\ N/kg)$

$F_g = 2.1\ Exp\ {-4} \times 9.8$

EE

$= 2.058 \times 10^{-3}\ N$

$F_{net} = ma = \Sigma F$ *

$ma = F_g - F_T$

$$a = \frac{2.058 \times 10^{-3}\ N - 2.0 \times 10^{-3}\ N}{2.1 \times 10^{-4}\ kg}$$

$a = 0.27619\ m/s^2$

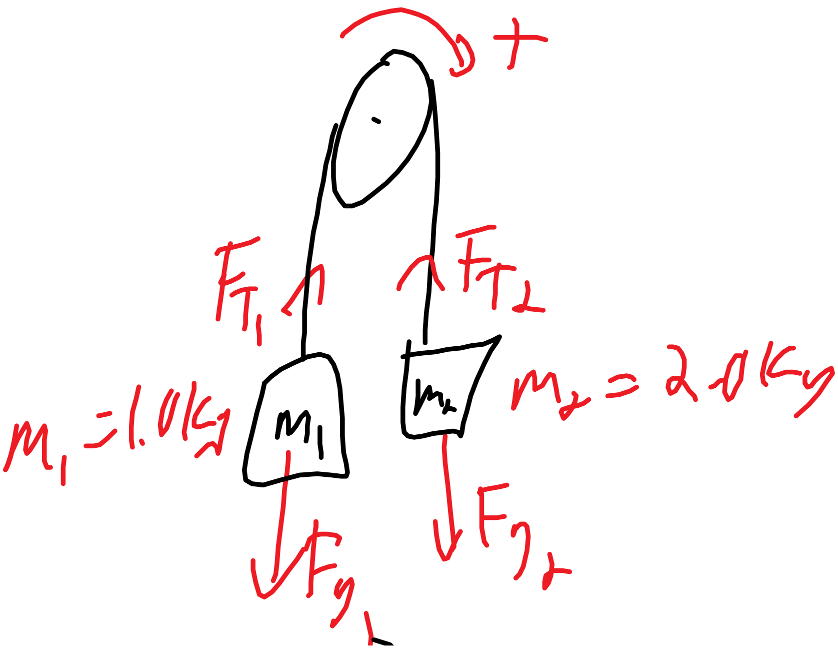
$$a = 0.28\ m/s^2 \text{ down}$$

$ma = F_T - F_g$

$m = (20 \times 75\ kg) + 500\ kg$

$2000\ kg\ a = 2.96 \times 10^4\ N - 2000\ kg(9.8)$

$$a = 5.0\ m/s^2 \text{ up}$$



$$F_{net} = ma = F_{g_2} - F_{g_1}$$

$$(m_1 + m_2)a = m_2 g - m_1 g$$

$$a = \frac{m_2 g - m_1 g}{m_1 + m_2}$$

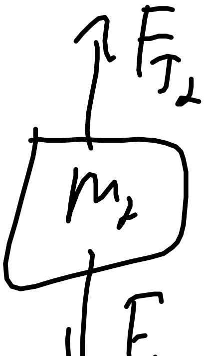
$$a = \frac{2\,kg(9.8\,N/kg) - 1\,kg(9.8\,N/kg)}{2\,kg + 1\,kg}$$

$$a = 3.2667\ m/s^2$$

$$\boxed{a = 3.3\ m/s^2}$$

$m_2 \downarrow$ $m_1 \uparrow$

b)



$\downarrow a = 3.2667\ m/s^2$

$$F_{g_2} - F_{T_2} = m_2 a$$

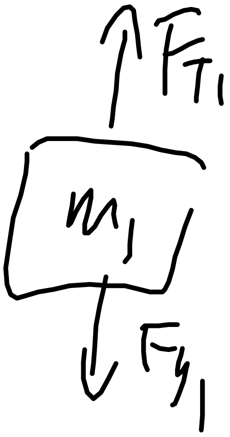
$$F_{T_2} - F_{g_2} = -m_2 a$$

$$F_{T_2} = F_{g_2} - m_2 a$$

$$= (2\,kg)(9.8\,\tfrac{N}{kg}) - 2\,kg(3.267\,\tfrac{m}{s^2})$$

$$= 13.067\ N$$

$$= \boxed{13\ N}$$



$\uparrow a$

$$m_1 a = F_{T_1} - F_{g_1}$$

$$F_{T_1} = F_{g_1} + m_1 a$$

$$F_{T_1} = (1\,kg)(9.8\,\tfrac{N}{kg}) + 1\,kg(3.267)$$

$$= 9.8 + 3.267$$

$$13.067\ N$$

$$= \boxed{13\ N}$$

Same!

Momentum and Impulse (chapter 9)

Momentum and Impulse (chapter 9)
not on the test next class

Review
What is inertia?
The tendency of an object to not accelerate.
objects at rest tend to stay at rest, objects in motion tend to stay in straight line constant speed motion.
Things with more mass have more linear inertia.

Momentum - inertia in motion
symbol is p (why, I don't know - pneumatics?)
define as the product of mass and velocity

$p=mv$ *

units: kgm/s

momentum is a vector - has direction - same direction as the velocity

What happens if you apply unbalanced force to a mass, m?
$F_{net}=ma$ acceleration $a=\Delta v/\Delta t$
$F_{net}=m\Delta v/\Delta t$ if the mass is constant then
$m\Delta v = \Delta p$
and
$F_{net}=\Delta p/\Delta t$ slope of the p-t graph is F_{net}

$\Delta p = F_{net}\Delta t$

We call this quantity, impulse
= Δp or $F_{net}\Delta t$ or area under the F_{net} - t graph

eg.
You throw a 0.145 kg baseball at
60 miles/hour (1.6km/mile)(1000m/km)(1hour/3600s)
60x1.6x1000/3600=26.6667 = 26.67m/s.
The batter hits the baseball and it goes back at -40.0 m/s. If the ball is in contact with the bat for 0.020s, what is the

a) momentum of the ball before and after being hit?
b) Impulse on the ball? Impulse on the bat?
c) Average force on the ball and bat while in contact?
d) keeners - sketch a graph of the force over time given it increases and decreases linearly.

study for the test
p178 Q1-4

a) p=mv= 0.145kg x 26.67m/s = 3.87 kgm/s before
= 0.145kg x -40m/s
= -5.8kgm/s

b) impulse = $\Delta p = F_{net}\Delta t$
= $p_f - p_i$ = -5.8kgm/s - 3.87 kgm/s

-5.8-3.87=-9.67 kgm/s on the ball
impulse on the bat is equal and opposite
9.67 kgm/s

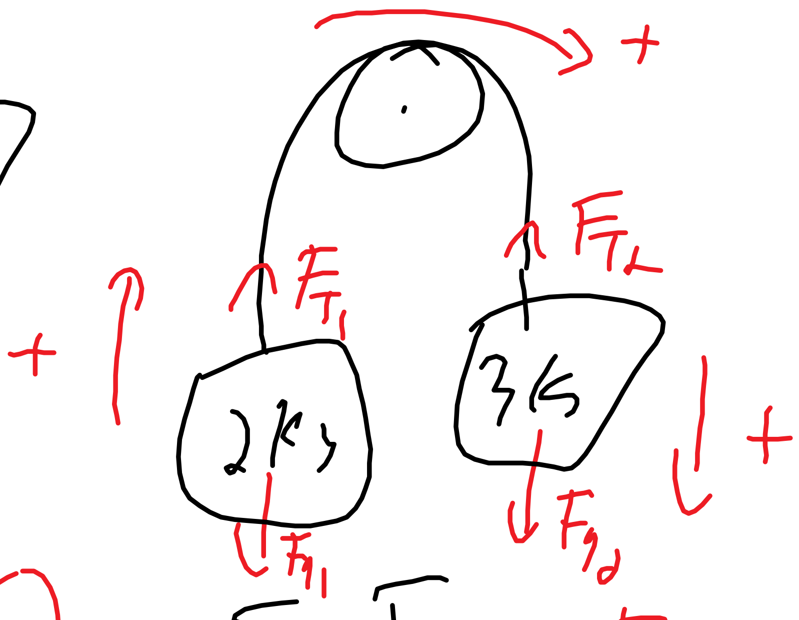
c) $\Delta p = F_{net}\Delta t$
$F_{net} = \Delta p/\Delta t = -9.67\text{kgm/s}/0.020\text{s}$

9.67/0.02=483.5
-4.8×10^2 N on the ball
$+4.8 \times 10^2$ N on the bat

d) keeners do this at home
everyone study for the test

P107

Q27



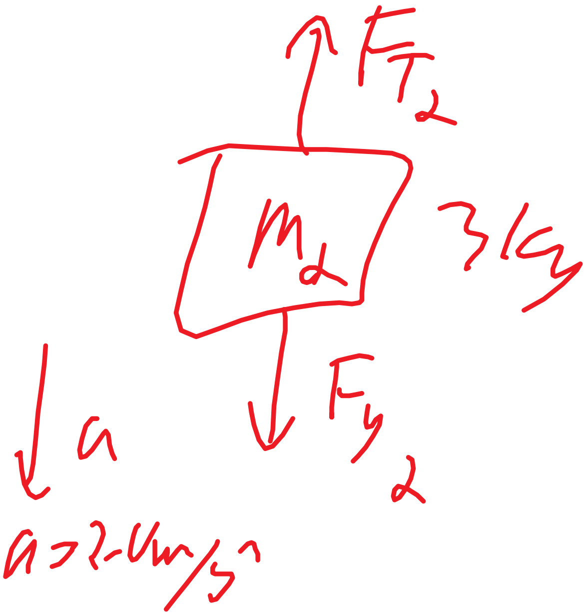
$F_{net} = ma = \Sigma F = F_{g_2} - F_{g_1}$

$m_1 + m_2$

$(m_1 + m_2)a = m_2 g - m_1 g$

$a = \dfrac{3kg(9.8\ N/kg) - 2kg(9.8\ N/kg)}{2\ kg + 3\ kg}$

$\boxed{a = 2.0\ m/s^2}$



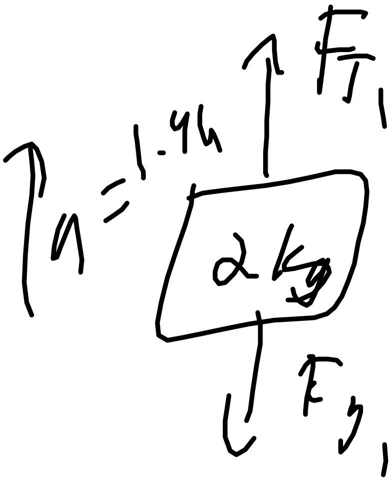
$ma = F_{g_2} - F_{T_2}$

$(3kg)(1.96\ m/s^2) = 3kg(9.8) - F_T$

$F_T = 23.52\ N$

$\boxed{F_T = 24N}$

$\uparrow F_T$



$$m_1 a = F_{T_1} - F_{g_1}$$

$$F_{T_1} = m_1 a + m_1 g$$

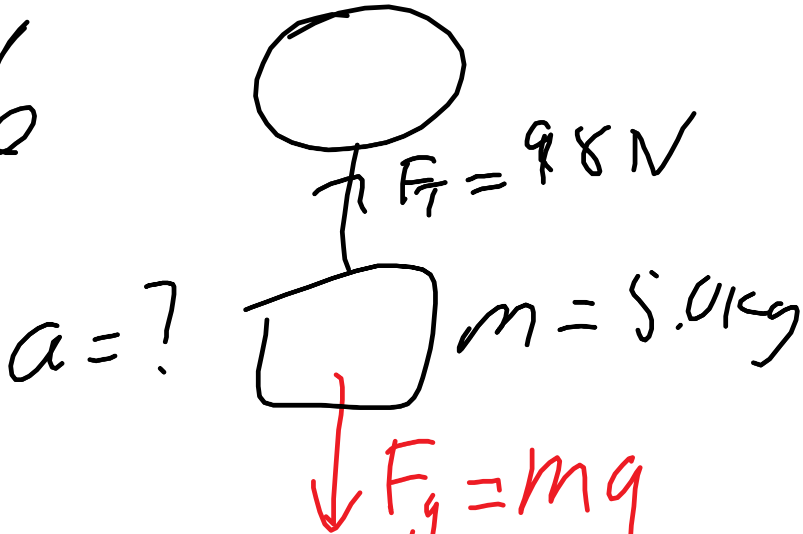
$$F_{T_1} = 2kg(1.96\,m/s^2) + 2kg(9.8\,N/kg)$$

$$= 23.52\,N$$

$$= 24\,N$$

Same!!!

Q26



$$F_g = mg$$

$$ma = \Sigma F = F_T - mg$$

$$a = \frac{98N - (5kg)(9.8N/kg)}{}$$

$$a = \frac{98N - (5kg)(9.8m/s^2)}{5kg}$$

$a = 9.8 m/s^2$ **up**

b) $t = 10s$ then $F_t \to 0$

$V_f = 9.8 m/s^2 (10s) = 98 m/s$ up

c) $F_{net} = F_g$ since $F_t = 0$

$= 49N$

d) $V_f = V_i + at$

$0 = 98 m/s^2 + (-9.8 m/s^2)t$

$t = 10s$

Q22

(5.1kg),

a) F_g

b) F_a start

(50kg)

b) F_a start

c) F_a v = constant

d) $a = 3.0 m/s^2$

$F_a = ?$

$\mu_s = 0.30$

$\mu_k = 0.10$

a) $F_g = mg = 50kg(9.8 N/kg)$

$= 490N$

b) $F_a = F_f$ if $a = 0$

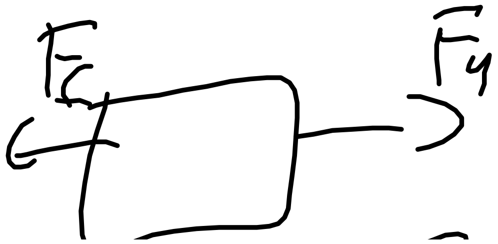
$F = \mu_s F_N = 0.30(490N)$

$F_a = 147N$

c) $F = \mu_k F_N = 0.1(490N)$

$F_a = 49N$

d)



$F_a - F_f = ma$

$F_a = ma + F_f$

$F_a = 50(3 m/s^2) + 49N$

$F_a = 199N$

Momentum and Impulse (chapter 9)
not on the test next class

Reminder:
Inertia - objects at rest tend to stay at rest, objects in motion tend to stay in constant speed, linear motion unless a force acts on it.

momentum - inertia with motion
define : the product of mass and velocity
symbol: p (pneumatics greek for forces?)

$p=mv$

units: kgm/s
vector quantity - has direction - same as the velocity

Impulse - a change in momentum

$\Delta p = ?$

$\Delta p = ?$

motion is changed by a net force

$F_{net} = ma \quad a = \Delta v / \Delta t$

$F_{net} = m\Delta v / \Delta t$

if m is constant then

$F_{net} = \Delta p / \Delta t$ or the slope of a p-t graph

$\Delta p = F_{net}\,\Delta t$ or the area under a F_{net} - t graph

eg.